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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/632,628 | 08/01/2003 | Bradley J. Howard | 2269-5862US (02-1563.00/ | 4766 |
| 24247 | 7590 | 07/27/2005 | EXAMINER | |
| TRASK BRITT P.O. BOX 2550 SALT LAKE CITY, UT 84110 | | | DHINGRA, RAKESH KUMAR | |
| | | | ART UNIT | PAPER NUMBER |

1763

DATE MAILED: 07/27/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | |
|------------------------------|------------------------|---------------------|--|
| Office Action Summary | Application No. | Applicant(s) | |
| | 10/632,628 | HOWARD, BRADLEY J. | |
| | Examiner | Art Unit | |
| | Rakesh K. Dhingra | 1763 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 03 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
 - If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
 - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
 - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 November 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-41 is/are pending in the application.
- 4a) Of the above claim(s) 25-40 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-24 and 41 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☒ Claim(s) 1-41 are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>8/03</u> . | 6) <input type="checkbox"/> Other: _____ |

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DETAILED ACTION

Election/Restrictions

Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-24, 41, drawn to multi-frequency plasma apparatus, classified in class 156, subclass 345.38.
- II. Claim 25-40, drawn to process for using frequency plasma reactor for etching process, classified in class 216, subclass 067.

The inventions are distinct, each from the other because of the following reasons:

Inventions II and I are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the apparatus as claimed can be used for non-etch process like deposition.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

Because these inventions are distinct for the reasons given above and the search required for Group I is not required for Group II, restriction for examination purposes as indicated is proper.

During a telephone conversation with Kevin K Johanson on 7/20/05 a provisional election was made without traverse to prosecute the invention of Group I, claims 1-24, 41. Affirmation of this election must be made by applicant in replying to this Office

action. Claims 25-40 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Specification

The disclosure is objected to because of the following informalities:

1) Paragraph 0021, line 5 – “conventional “ does not seem to be correct, since the matchbox normally matches impedance between generator and plasma/chamber. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter, which the applicant regards as his invention.

Claim 1 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention because term “openly” (in line 1 of claim) is does not find support from specification in terms of MPEP 608.01(i)(d) 1.

For the purpose of examination, “openly” is presumed as “operably”.

Appropriate correction/clarification is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject

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matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 2 are rejected under 35 U.S.C. 103(a) as being unpatentable over DeOrnellas et al (US Pub. No. 2002/0139665) in view of Corn et al (US Pub. No. 4,585,516).

Regarding Claim 1: DeOrnellas et al teach a plasma apparatus (Figure 1), comprising upper electrode 26, lower electrode 28 and power generators 30, 32, 34 coupled to upper and lower electrodes. (Paragraphs 0023, 0024).

DeOrnellas et al do not teach controller.

Corn et al teach an apparatus (Figure 1) that has a control means (controller) 27 for controlling the signals applied to the reactor to improve etching capability of the apparatus (Column 2, lines 45-55 and Column 1, lines 36-38). Corn et al further teach that the apparatus uses at least two (implying there could be three sources) sources of RF power (Column 1, lines 42-45).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use control means (controller) as taught by Corn et al in the apparatus of DeOrnellas et al to achieve improved etching capability.

Regarding Claim 2: DeOrnellas et al teach that first power generator 30 is connected to upper electrode 26 and second and third power generators 32, 34 are coupled to the lower electrode 28.

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Claims 1, 2, 3, 9, 10, 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Roderick (US Patent No. 6,043,607) in view of DeOrnellas et al (US Patent No. 6,492,280).

Regarding Claims 1, 2: Roderick teaches an apparatus (Figures 1-3) that comprises first, second, third generators 118.sub.1, 118.sub.2, 118.sub.3 coupled to upper and lower electrodes 126, 114 and a controller (feedback control device) 300 (Column 3, lines 1-20). Roderick further teaches that the feedback control device (controller) 300 provides dynamic control of signal characteristics of the three signals (column 4, lines 12-50).

Roderick does not specifically teach the electrodes to which the generators are coupled.

DeOrnellas et al teach an apparatus (Figure 6) that has generators 48, 50 coupled to lower electrode 42 for obtaining wafer etching with straight vertical sidewall profiles.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use power generators coupled with electrodes as taught by DeOrnellas et al in the apparatus of Roderick to achieve wafer etching with vertical sidewall profiles.

Regarding Claims 3: DeOrnellas et al teach that RF sources 48 has a frequency of 450 KHz and RF source 50 has frequency of 13.56 MHz, that is frequency of second generator 50 is three times that of third generator 48 (column 5, lines 1-10).

Regarding Claims 9,10,11: Roderick teaches that feedback control device 300 (controller) dynamically controls one or more signal characteristics like amplitude, power, frequency of the signal produced by each of the generators (column 4, lines 15-20).

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Claims 1, 2, 4, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Salimian et al (US Patent No. 5,656,123) in view of DeOrnellas et al (US Patent No. 6,492, 280).

Regarding Claims 1, 2, 16: Salimian et al teach an apparatus (Figure 1) that comprises a vacuum chamber 14, generators 12, 16 coupled to upper and lower electrodes 20, 22 (column 5, lines 35-55).

Salimian et al do not teach third power supply and controller.

DeOrnellas et al teach an apparatus (Figure 6) that has generators 48, 50 coupled to lower electrode 42 and a controller 54 for obtaining wafer etching with straight vertical sidewall profiles.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use third power generator and controller as taught by DeOrnellas et al in the apparatus of Salimian et al to achieve wafer etching with vertical sidewall profiles.

Regarding Claims 4: DeOrnellas et al teach that two RF sources 48 (450 KHz) and 50 (13.56 MHz) coupled with lower electrode 42, and a controller 54 for sequencing the power supplies (column 4, lines 65-67 and column 5, lines 1-10). Thus frequency of first power generator 12 (60 MHz – Salimian et al) is greater than frequency of second power generator 50 (13.56 MHz – DeOrnellas et al) and that of third power generator 48 (450 KHz – DeOrnellas et al).

Regarding Claims 12, 18, 19: Salimian et al in view of DeOrnellas teach that the first power generator 12 (Salimian et al, Figure 1, Column 4, lines 50-52) is capacitively coupled to the upper electrode 20 and the second and third power generators 48, 50

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(DeOrnellas et al, Figure 6, Column 7, lines 55-60) are capacitively coupled to the lower electrode 42.

Regarding Claims 13, 21: DeOrnellas et al teach that the second power generator 50 operates in MHz range frequencies at about 1 MHz and up to multiples of 13.56 Mhz (includes 13.5 Mhz to 60 Mhz) can be used (column 5, lines 1-10).

Regarding Claims 14, 22: Salimian et al teach that for the first power generator 12 signal in the range of 30 MHz to 300 MHz (includes 40 Mhz to 100 MHz) could be used (column 5, lines 65-68).

Regarding Claims 15, 23: Salimian et al teach that for the third power generator 16 signal could be applied in the range of 0.1 MHz to about 30 MHz (includes 1 MHz to 13.5 MHz); (column 6, lines 1-5).

Regarding Claim 17: Salimian et al teach (Figure 1) that upper electrode 20 is arranged above the wafer table 46.

Further DeOrnellas et al teach (Figure 6) that lower electrode 42 is coupled with wafer chuck (table) (column 4, lines 55-60).

Regarding Claims 20: DeOrnellas et al teach that RF sources 48 has a frequency of 450 KHz and RF source 50 has frequency of 13.56 MHz, that is frequency of second generator 50 is three times that of third generator 48 (column 5, lines 1-10).

Claims 1, 2, 5, 6, 7, 8, 9, 10, 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over DeOrnellas et al (US Pub. No. 2002/0139665) in view of Corn et al (US Patent No. 4,585,516) as applied to claims 1, 2 and further in view of Tsuchiya et al (US Patent No. 5,716,5340).

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Regarding Claim 1: DeOrnellas et al teach a plasma apparatus (Figure 1), comprising upper electrode 26, lower electrode 28 and power generators 30, 32, 34 coupled to upper and lower electrodes. (Paragraphs 0023, 0024).

DeOrnellas et al do not teach controller.

Corn et al teach an apparatus (Figure 1) that has a control means (controller) 27 for controlling the signals applied to the reactor to improve etching capability of the apparatus (Column 2, lines 45-55 and Column 1, lines 36-38). Corn et al further teach that the apparatus uses at least two (implying there could be three sources) sources of RF power (Column 1, lines 42-45).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use control means (controller) as taught by Corn et al in the apparatus of DeOrnellas et al to achieve improved etching capability.

Regarding Claim 2: DeOrnellas et al teach that first power generator 30 is connected to upper electrode 26 and second and third power generators 32, 34 are coupled to the lower electrode 28.

DeOrnellas et al in view of Corn et al teach all limitations of claims 1, 2.

Regarding Claims 5 through 11: DeOrnellas et al in view Corn et al teach all limitations of claim except placement of power generators in active/inactive mode.

Tsuchiya et al teach an apparatus (Figures 1, 30-33) that uses CPU (controller) 20 to control power supplies 18, 29 for ON/OFF (active /inactive) modes to optimize the etching parameters (, column 9, lines 1-15 and column 12, lines 45-65 and column 13, lines 1-25). Tsuchiya et al further teach that etching parameters can be optimized by

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appropriately selecting the parameters including phase difference and the power ratio of the generators (column 8, lines 20-25).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use controller as taught by Tsuchiya et al in the apparatus of DeOrnellas et al in view of Corn et al to optimize the etching parameters.

Regarding Claim 41: Tsuchiya et al teach an apparatus (Figures 1, 30-33) that uses CPU (controller) 20 to control power supplies 18, 29 for ON/OFF (active /inactive) modes to optimize the etching parameters (column 9, lines 1-15 and column 12, lines 45-65 and column 13, lines 1-25). Tsuchiya et al further teach that etching parameters can be optimized by appropriately selecting the phase difference and the power ratio of the generators (column 8, lines 20-25).

Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Salimian et al (US Patent No. 5,656,123) in view of DeOrnellas et al (US Patent No. 6,492, 280) as applied to claim 16 and further in view of Roderick (US Patent No. 6,043,607).

Salimian et al in view of Dornellas et al teach all limitation of claim except controller being operable to place the three generators in a plurality of configurations.

Roderick teaches that feedback control device 300 (controller) dynamically controls one or more signal characteristics like amplitude, power, and frequency of the signal produced by each of the generators to achieve optimal plasma excitation (column 4, lines 15-20).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use controller that can operate so as to be able to place the three

generators in a plurality of configurations, in the apparatus of Salimian et al in view of DeOrnellas to to achieve optimal plasma excitation.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Grewal et al (US Patent No. 5,597,438) teach an apparatus (Figure 2) that uses three separate RF sources 38, 46, 50 and which provides independent control of three electrode members 36, 42, 48.

Lantsman (US Patent No. 5,948,215) teach an apparatus (Figure 1) that uses a controller 50 that controls a DC power supply 20 and auxiliary RF generator 24 connected to cathode 17 and a bias supply connected to lower electrode 14.

Additionally there is a coil 30 that provides secondary plasma and is powered by RF generator 32.

Donohoe et al (US Patent No. 6,309,978) teach an apparatus (Figure 1) that provides modulated bias plasma using a RF source which includes multiple sources 34, 35, 36 to provide different driving frequencies which interfere with one another to produce one or more beat frequencies.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rakesh K. Dhingra whose telephone number is (571)-272-5959. The examiner can normally be reached on 8:30 -6:00 (Monday - Friday).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571)-272-1435. The fax phone

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number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Rakesh Dhingra



Parviz Hassanzadeh
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